15.3: Data and Analysis

Data Collection

(Acquiring competencies) Following your detailed protocol based on the videos, perform all the experiments. Record your observations and take pictures of your key steps in the process. Your observations and images need to be incorporated in your data section and this section should be as detailed as possible as you will use this information to complete your discussion.

Data Processing

1. (Representation) Write the balanced chemical equation for the reaction observed in the first part of this experiment.
2. (Interpretation) Using your balanced chemical equation that describes the observed reaction, interpret its meaning on the microscopic (molecules/formula units) and macroscopic scale (moles).
3. (Manipulation) Assuming that all the baking soda from your balloon reacted, calculate how many moles of carbon dioxide gas would be formed.
4. (Manipulation) Assuming that all the acetic acid (assume 5% by mass with a density of 1.006 g/ml) from your Erlenmeyer flask reacted, calculate how many moles of carbon dioxide gas would be formed.
5. (Analysis) Using your calculations, identify the limiting reactant of your reaction and determine the maximum amount (in moles) of carbon dioxide that could be produced.
6. (Manipulation) Using your calculated number of moles of carbon dioxide from Question 5, the atmospheric pressure, the vapor pressure of water at your room temperature, and your room temperature value, calculate the expected volume of the balloon.
7. (Manipulation) Using your measurement for the circumference of the balloon, calculate the volume of the gas in the balloon.

Radius: $r = \dfrac{\text{circumference}}{2p}$

Volume: $V = \dfrac{4}{3} \times \mathrm{p} \times r^3$

8. (Manipulation) Using the expected and the measured volumes of the carbon dioxide, calculate the percent yield of the experiment.
9. (Manipulation) Calculate the expected volume for 1 mole of an ideal gas under atmospheric pressure and you room temperature conditions.
10. (Manipulation) Using your measured gas volume and calculated moles from Question 5, calculate the molar volume of your collected carbon dioxide gas.
11. (Manipulation) Considering the value calculated in Question 9 the correct value for the molar volume under your reaction conditions, calculate the error for the molar volume in your experiment. (Hint: the calculated value from Question 10 is your experimental molar volume.)
12. (Representation) Write the balanced chemical equation for the reaction between the magnesium strips and the hydrochloric acid solution.
13. (Interpretation) Describe the meaning of the chemical equation on the microscopic and macroscopic scale.
14. (Manipulation) Calculate the moles of hydrogen gas expected from the reaction of HCl with Mg. Use stoichiometry, appropriate units and consider the significant figures.
15. (Manipulation) Calculate the actual moles of hydrogen gas produced using the collected volume of gas. (HINT: the gas was collected over water.)
16. (Manipulation) Calculate the % yield of the reaction. $[\text{Actual moles of } \mathrm{H_2(\,g)} / \text{ expected moles of } \mathrm{H_2(\,g)}] \times 100\%$
17. (Assumptions and Analysis) Fill in the following table using the observations and data from your experiments.

Assumptions made	Testing the assumption	If assumptions are wrong ...

Assumptions made	Testing the assumption	If assumptions are wrong ...
All the baking soda is consumed in the reaction.		